Information Systems Development Support (ISDS) Contract Work Order (CWO) Implementation Plan

for

CWO 2 - Command Processor Assembly (CPA) OP-C Software

Developed by
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Under

Contract No. 960100
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for the

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Foreword

Due to the timing of these Work Implementation Plans (WIPs) relative to (i.e., subsequent to) the start of the current DSN development efforts, a slightly different approach is being used than would normally be the case. WIPs document the planning that normally precedes development. The document then grows and is modified, if necessary, to reflect a dynamic development environment. Since much of the detail already exists for tasks already in progress at the beginning of the ISDS contract, the WIP references existing detail without significant elaboration. The WIP is envisioned as a central repository to pull together, by reference or inclusion, all the information available for a particular development task. The objective of this exercise is to provide all the information necessary to plan for, then to monitor and control the progress of each development task. This will be done with an eye on improving the total product and reducing redundancy and, thus, paper. Future WIPS will incorporate CASE and other development tools, when authorized, to reduce documentation costs and provide for the integration of the design and documentation processes into a single homogeneous (seamless) process. That is, documentation will be produced as a natural result of the planning, design and implementation process rather than as a separate activity.

Preface

This is the top-level CWO document used for defining and controlling the effort, organizational structure, management authority and responsibility, and resource allocations for the CWO. This is the baseline for continued enhancement and maintenance of the technical and management document developed under the guidelines set forth in DRD MA005 and in the ISDS Program Management Plan and is supported by the ISDS methodology.

The **order of precedence** is the ISDS contract and attachments, then the ISDS Project Management Plan and its supporting procedures, and then this plan. The ISDS Project Management Plan and supporting procedures can be explicitly waived with the concurrence of JPL and ISDS team management. Such actions and decisions are documented in Section 11, Deviations, Exceptions, and Waivers.

Table of Contents

1.   Introduction

The Command Processor provides the interface between the command generation function and the uplink transmission function of the Deep Space Network (DSN).

1.1   Background

Anomalies (software discrepancies) have been encountered over the past months in commanding space vehicles through the DSN. Though these anomalies are not critical to the operation of current spacecraft, their correction is important to smooth operation of the uplink command function.

1.2   Purpose

The purpose of this CWO is to provide anomaly isolation and correction and operability improvements to the existing CPA software which is currently supporting earth orbit and inter-planetary uplink commanding of existing and future space vehicles. Planning has been completed and work is in progress as this CWO begins.

1.3   Goals

In addition to implementing the above functionality, JPL's goals focus on continued JPL/DSN modernization, taking full advantage of the latest technology, tools and development processes supporting a concurrent engineering paradigm. The major goal of this and other JPL/DSN development efforts is to reduce system life-cycle costs through the development paradigm described under the "Software Development Plan described below.

2.   SOW & Deliverables

The Statement of Work for CWO 2, ASF Software, is stated verbatim as it appeared with the original request for estimate, including deliverables and the attached Engineering Change Request, ECR NUMBER: 94.0068.

2.1   SOW

CWO TITLE:

Command Processor Assembly (CPA) OP-C Software.

BACKGROUND:

This statement of work covers the update and delivery of the OP-C version of the Command Processor Assembly Software.

TASK DETAILS:

All work on the CPA Software Upgrade shall be in accordance with JPL D-4000 Standards. The contractor shall assist the JPL CDE with the modifications necessary for the CPA OP-C software upgrade. The OP-C software shall correct the anomalies and implement the operability improvements listed in ECR 94.0068, including correcting the 100 msec Bit-1 time slip problem and providing an abort capa-

bility for short command elements whenever Transmitter or Command Modulation are turned off. This version of software will also include other anomaly corrections/operability improvements deemed as necessary by the JPL CPA CDE.

The contractor shall provide the following:

@ Engineering and pre-acceptance test versions of CPA OP-C software, including modifications for the 100 msec Bit-1 time slip problem and Transmitter/Command Modulation abort capability.

@ Acceptance test readiness review report.

@ CPA OP-C software (source and object) with D-4000 documentation.

CPA program build procedure.

@ Programmer's notes.

The contractor shall provide support for engineering, pre-acceptance, and acceptance testing of the CPA OP_C software. Following completion of acceptance testing, the contractor shall assist the CPA CDE and in diagnosing CPA software anomalies that may occur during soak testing.

SCHEDULE AND DELIVERABLES:

@ CWO Start Date:	11/17/94
@ Preliminary CPA SOM:	5/1/95
@ Preliminary STP 1&2:	5/19/95
@ CPA pre-Acceptance test version:	6/2/95
@ CPA Acceptance Test Readiness Review Report:	6/23/95
@ CPA pre-Acceptance testing complete:	6/30/95
@ CPA Acceptance Test software and preliminary RDD:	7/3/95
@ Acceptance testing complete:	7/28/95
@ Final STP- 1&2 and RDD documents:	8/4/95
@ Final STP-3 document:	8/18/95
@ Final SSD-1 document:	8/25/95
@ Final SSD-2 document:	9/1/95
@ Assist in CPA software problem diagnosis:	8/1/95 - 9/17/95
@ CWO close date:	9/17/95

ENGINEERING CHANGE REQUEST

        ECR NUMBER: 94.0068

DATE PRINTED: 19 AUG 94, TIME: 12:21 DATE ORIGINATED: 05 AUG 94

*** Placed on the QUEUE FOR FUNDS ***

ECR TITLE: [DCD] OPERABILITY IMPROVEMENT UPGRADE

ORIGINATOR: GARCIA/STINNETT BADGE NUMBER:

SECTION: 398

APPEAL: NO

KEY SUBSYSTEM/ASSEMBLY: 41.900 DSCC Command Subsystem Software

OTHER SUBSYSTEM/ASSEMBLY: NONE IDENTIFIED

APPLICABLE FACILITIES:

GOLDSTONE - SPC 10

CANBERRA - SPC 40

MADRID - SPC 60

JPL/OTHER - MIL 71/CTT 22/DTF 21

CHANGE CLASSIFICATION: NEW CAPABILITY

PRIORITY: ROUTINE

No threat to either the successful performance of a mission, or to personnel. Process in a timely manner.

TYPE: PERMANENT

NEED FOR THIS CHANGE:

Improve operator interface/CDC reliability.

PROPOSED SOLUTION:

1. Correct/resolve the following anomalies/problems in the CPA software and CMA firmware and incorporate the listed operability improvements.

Anomalies:

CPA Anomalies:

AR # 21435

The bit one time of delayed elements sometimes slips 100 msecs. This is an intermittent problem for low bit rate missions.

AR # 22451

The Transmitter and Command Mod off aborts don't function when radiating short command elements at high bit rates.

AR #23951

CPA re-computes delays between elements when it shouldn't if the active mode is disabled in the delay period between command elements.

AR # 23952

The CPA stores execute tone blocks with command blocks on the diskette as part of Throughput Emergency command files.

AR # 23954

> After the CPA has been operated [and] GCF D entered, when GCF communications are re-enabled, the TODR does not terminate, but stays active until the software is reloaded.

CMA Anomalies:

AR # 23955

> Sporadic command shift register alarms causing command abort.

Other Problems to Look Into:

> Look into the subcarrier frequency alarms experienced by Pioneer 10 & 11. Verify that the problem is corrected by the OP-F firmware. If not, find and correct the cause of the problem.

Operability Improvements:

AR # 18159

> The CPA doesn't display 26M transmitter bypass or PA status.

> Modify the CPA to echo command blocks from NOCC when the project is operating in the through-put protocol with ECHO disabled.

> Remove exciter frequency alarm from the CPA software.

2. Deliver updated D-4000 documentation for both the CPA software and CMA firmware.

IMPACT IF NOT DONE: NOT IDENTIFIED:

COST IMPACT OF THE CHANGE:

$190K

RELATED ECR(s): NONE IDENTIFIED

ATTACHMENT NO. 2 "CWO 2 FUNDING DETAILS"   11/10/94

Funding authorization is through 9/17/95 only.

Beginning with the start of the CWO, the effort shall be charged [100% to] JPL Account Number 412-26818-0-3940

Staffing

It is expected that this effort will be staffed at 1.0 work months per month throughout the period of performance.

There are no key Telos people identified for this effort, although previous experience on Telos CWO 24 would be helpful in understanding the scope of the effort and in developing a cost estimate. The Telos personnel previously working on Telos CWO 24 include Kolin Hand and Pam Holden.

Key personnel: None

2.2   Deliverables

Deliverables are as stated in the SOW, above.

2.2.1 CWO-Specific Deliverables

2.2.2 Deliverables Required by Contract or Derived from the CWO

1. MA005 - CWO Implementation Plan draft, final, and updates as required

2. MA006 - Monthly Progress Report

3. MA007 - CWO Weekly Status and Major Problems Report

3. Software Development Plan

CPA software will be developed in a **TBD** environment. Modern programming languages will be used to insure portability. Legacy software from the Multi-Use library will be used along with as much COTS software as possible to reduce development costs and development risks. Software will be written for inclusion in the Multi-use library when appropriate. The intent is to provide lower development costs without impacting the major goal of reducing system life-cycle costs for this or other DSN development efforts.

3.1 Technical Approach

This is a one-programmer effort not including test and documentation support. The technical approach is driven by the need to upgrade the CPA to increase operability and correct existing anomalies. Schedules and priorities are not directly linked to critical operations. Analysis and design documentation reflecting this effort will be provided to technical editors and documentation techs for development of the D-4000 documentation.

3.1.1 Recapitulation of Requirements

Since this Work Implementation Plan is being produced in the middle of a development effort, no recap. of requirements is necessary at this time past that documented in the Functional Requirements Document (FRD) and System Requirements Document (SRD). Normally, if this plan were written at the beginning of a task, this section would contain a high--level overview to be expanded into the more detailed D-4000 documentation.

3.1.2 System Operations Concept

Since there is increased functionality provided in this upgrade, there will necessarily be corresponding changes to the Software Operator's Manual (SOM). The new operation concept is being provided in the SOM. Insofar as possible, user training will be provided in conjunction with other activities that bring developers and users together.

3.1.3 Level of Application of the Methodology

Since development is already under way and is in the coding stage, the application of methodology will continue as is. Introduction of CASE tools and formal development processes other than those already in use would cause more problems than they would solve due to the learning curve. Since there is only one programmer associated with this CWO and his time will be occupied providing the software product, assistance will be offered for as many administrative functions (e.g., from analysis/design to D-4000 standard format) as possible.

3.1.4   Overall Approach

The overall approach is to continue with the current development begun by the CDE. The programmer, Randy Tang, is scheduled to begin approximately two months late. Success of this CWO will rely heavily upon the ability of the CDE to communicate the system features to Mr. Tang and Mr. Tang's ability to become productive in a short time span.

3.1.4.1   Requirements Definition and Analysis

Requirements analysis was completed prior to this CWO. If new requirements are added, in order to support unexpected mission needs. It will be dealt with as follows:

1. Prioritized will be kept so that new requirements that are high priority get implemented, at the expense of lower priority requirements if necessary.

2. Overtime will be requested when necessary.

Development will be monitored through technical interchange meetings and Software Development Folders to insure requirements are being satisfied.

3.1.4.2   Architectural Design

Design will be performed through structured analysis and design using the Yourdon/Demarco methodology. Design will be completed subsequent to Randy Tang's arrival on this CWO. Spiral Model will be used to assess and mitigate risk. Development will be monitored through technical interchange meetings and Software Development Folders to insure design is being implemented. As development progresses, any need for redesign will be assessed and communicated to cognizant personnel.

3.1.4.3   Software Implementation

Data flows will be used to determine overall design and functional interfaces. Structure charts will be used to provide module dishing. Module size will be determined by this design to be approximately 55 lines of source code, plus or minus 50 lines. Software Development Folders will be used by the cognizant programmer to document design path, allocation of requirements to modules, results of peer reviews for both design and code as well as for unit test results. Administrative forms will be provided to make easier the task of documenting these activities.

3.1.4.4   Software Integration and Test

Test plans will be written in adherence to the requirements and the SOM in cooperation with the programming staff due to the small size of the project, programming staff time is allocated for their assistance in the testing function.

3.1.4.5   Installation and Training

Neither installation nor training is part of this CWO. Insofar as possible, user training will be provided in conjunction with other activities that bring developers and users together. Training will be conducted in parallel with Acceptance Testing and design reviews to take advantage of periods of time that customer and developer are co-located.

3.1.4.6   Maintenance and Sustaining Engineering

Strictly speaking, this CWO consists primarily of maintenance of an existing system. Increased operability suggests new development, however, in which case, analysis, design and implementation meth-

odology can have a dramatic effect on the ease of maintenance and corresponding system life-cycle cost subsequent to implementation. Since a CASE tool is not being used, much more emphasis will be placed on informal reviews, to remove interface errors before they become coding bugs, and unit and integration testing to isolate and correct discrepancies prior to installation.

During the final days or weeks of the implementation phase, the basis for system maintenance will be established. The approach for this effort is based on two activities. The first is responding to requests for assistance in a timely manner. The goal of this response is to either resolve the problem or to characterize it in a short period of time. If the problem cannot be resolved, it will be recorded so that resources can be assigned to it consistent with all other priorities of work. The second is examining written (machine readable) records; e.g., outstanding Anomaly Reports (ARs), ISDS problems, and requested changes to first decide the contents of the next

3.2 Integration & Build Approach

This section describes the overall approach for integrating software components into releases, testing release functionality, and demonstrating operability to JPL through acceptance testing.

3.2.1 Responsibility

Jerry Hill, the CWO manager, is responsible for planning and coordinating overall testing and integration activities. He and the cognizant programmer will be provided with administrative support in preparing for the pre-acceptance testing and in providing their input to the design and user documentation.

3.2.2 Integration & Test Activities

Integration will occur when the build-specific software has been successfully unit tested and placed under configuration management. The cognizant programmer will assist the test team in integrating and testing the ASF software.

3.2.2.1 Integration Approach

TBD

3.2.2.2 Test Approach

TBD

3.2.2.2.1 Scenarios

TBD

3.2.2.2.2 Pre-acceptance Testing

TBD

3.2.2.2.3 Acceptance Criteria

TBD

3.3 Resources Required

Required GFE/GFI resources are described in Section 9.

3.3.1 Development Tools & Resources

Development tools are those already in use as this CWO begins. An effort will be made to integrate a CASE tool into this development effort, though the duration of the project is probably too short to accommodate this automation and associated training.

3.3.2 Integration & Test Resources

In addition to the JPL staff allocated to independent test functions, ISDS will allocate configuration management and administrative assistance to the cognizant programmers in preparing for and providing integration and test support.

3.3.3 Support Resources

Support staff consists of 4 people including the CWO Manager. They will support the cognizant programmer in providing all deliverables.

3.3.4 Cost and Schedule Planning

CWO 15 is currently costed at 1827 staff hours, of which 1562 staff hours are allocated to cognizant programmer time. These figures were based on an estimate which assumed full staffing as of 1 December 1994. Since the Telos staff for this and several other tasks was not captured, there will be a late start, reducing the total hours by approximately 350 staff hours. Those 350 staff hours are available for overtime, if schedules can't otherwise be met.

3.3.5 Project Management Tools

ISDS uses MS Project, Excel, and Word to provide project management support.

3.4 Product Assurance Plan

It is ISDS policy to combine Process Assurance as the combination of Configuration Management, (CM) Quality Assurance (QA), and Process Management into Process Assurance. Each of the sub-activities is intrinsically tied to and dependent on the others for success. The primary instance for quality assurance is in the use of structured, but informal peer reviews and unit testing, all of which are documented, along with requirements allocation, in Software Development Folders.

3.4.1 Introduction

The CM plan for this CWO is derived from and consistent with the ISDS Project CM Plan. This section is laid out in accordance with CSC SSDM Standard 6107.

3.4.1.1 Organization & Responsibilities

The ISDS Product Assurance Officer (PAO), is the configuration management officer (CMO). The PAO reports to management independent of the Program Manager and CWOs. The CMO performs configuration management and data activities as outlined in this CM Plan.

The Configuration Control Board (CCB) for this CWO consists of the CWO Task Manager, the ISDS Program Manager and the JPL CWO Manager, at a minimum..

3.4.1.2 Configuration Identification

3.4.1.2.1   CI Definition

See Table 3.4.1.2.1-1

Table 3.4.1.2.1-1 CWO Configuration Items

Title or Description	Versions	Notes
CWO Implementation Plan	Draft, Revised, Final	Refer to ISDS CDRL MA 005; includes plans for Software Development, Development Review, Software QA, CM, Integration and Test, Software Progress Metrics, Staffing & Profile, and Cost & Schedule, at a minimum
CWO Weekly Status and Major Problem Report	One/Week	Administrative data including updates to CWO status and schedule
Requirements Documentation	Draft and Final	Includes software, hardware and interface requirements documents and specifications which define the Allocated Baseline
Design Documentation	Preliminary, Detailed, Final	Includes design specifications which define the Development and Product Baselines
Source code/libraries	Internally Configured, Baselined	Source code following peer review approval and QA inspection/certification controlled by 'gatekeeper'; updated for Product Baseline
Executables	Internally Configured, Baselined	Object representation of source code following peer review approval and QA inspection/certification controlled by 'gatekeeper'; updated for Product Baseline
Build Procedures	Draft, Final	Procedures defining software release approach
Test Plans/Procedures and Reports	Draft, Final	Includes test data for CIs, the system, acceptance, and operation
Requirements Traceability (Matrix)	Initial, Design Update, Test Update	Matrix traces requirements from system to CIs (Initial), to design documentation, then to test documentation
Training Materials	Draft, Final	Generated following completion of Operational Baseline
User Documentation	Draft, Final	Generated as part of Product Baseline
Operational Baseline/Version Deliverables	Baselined, Updates	Consists of documentation updates to the Functional, Allocated and Product Baselines, and approved acceptance and operational test documentation
Discrepancy/Change Request Forms/Modifications and Repairs	As Required	This includes ECRs, SCNs, DWRs, ECOs and System Problem Reports (SPRs)

3.4.1.2.2 Baselines

Baselines are identified in the previous table. ISDS may choose to internally baseline software or documents even when there is no formal delivery to a JPL organization; e.g., SPMC. We do this to control change to volatile or risky areas of CWOs.

3.4.1.3   Configuration Control

3.4.1.3.1 Change Classification

ISDS is compatible with JPL change classification except in two areas:

1. We may classify changes for internal baselines differently than JPL would classify the changes.

2. We typically differentiate between problem fixes (e.g., ARs) and changes of enhancements.

3.4.1.3.2 Change Control Procedures

Change control for this CWO is fully compliant with the change control procedures in the ISDS CM Plan. Mention must be made of several key points:

1. A problem fix, once authorized, is its own authorizing document.

2. An enhancement or change to a baseline typically undergoes a multi-step (and incremental) approval process.

    • Approval to generate the specification and estimate for the change

    • Approval to implement the change based on an approved specification and estimate.

3. A detailed estimate includes all code units and whether they are new, modified, adapted, or converted; all document sections; all training materials; all test scenarios; and all tools.

3.4.1.3.3 Change Implementation and Verification

  TBD

3.4.1.3.4 Software Library Control

Formal software control of deployed software is through SPMC. Internal software is controlled by having a separate account on the development machine running SCCS.

3.4.1.3.5 Software Support Environment Control

N/A

3.4.1.4   Configuration Status Accounting

  TBD

3.4.1.5   Configuration Audits

  TBD

3.4.1.6   Data Management

  TBD

3.4.1.7   Configuration Management Tools

• *****TBD*****

3.4.1.8   Records Collection and Retention

TBD

3.4.2   Software Quality Assurance Plan

The QA Plan for this CWO is derived from and consistent with the ISDS Program QA Plan.

3.4.2.1   Scope

All delivered products are subjected to QA. All products and tools used to generate internal baselines are subject to QA.

3.4.2.2   Evaluation of Products

All software units, documentation, tests are subjected to multi-stage, in-process review.

3.4.2.3   Verification of Processes

Periodically, the CWO manager and PAO will check CWO adherence to established processes and 'best practices'.

3.4.2.4   Course Correction

QA is responsible for determining when problems are not being resolved to the customers satisfaction and reporting this to the CWO manager and program manager.

3.4.2.5   Productivity and Quality Goals

TBD

3.4.3   Review Plan

3.4.3.1   Timing and Location of the Reviews

Formal reviews will be held at the ISDS facility or at the JPL facility based on convenience to the developers.

3.4.3.2   Notification, Agenda and Attendees

Under normal circumstances, the CWO manager, Jerry Hill, would be responsible for notifying JPL in advance of a proposed internal review and providing an agenda and list of proposed attendees. Since this CWO starts after the actual task has already begun, the current approach for scheduling meetings will be continued unless JPL management determines a different course of action.

3.4.3.3   Minutes and Action Items

The PAO is responsible for keeping minutes and action items, for posting them in the CWO database, and for routing them to the responsible parties. The responsible parties will return the proposed resolution to Jerry Hill for review and approval.

Jerry Hill will provide a draft set of minutes and action items within one week of the review and will continue to report the status of action items on a weekly basis to the CWO 2 Task Manager until all action items have been resolved.

3.4.4 Documents

3.4.4.1 Installation & Training Plans - not req'd - See 3.1.4.5

3.4.4.2 Maintenance and Sustaining Engineering Plan - not req'd - See 3.1.4.6

4. Management Approach

The management approach for this CWO is derived from and is consistent with the ISDS Program Management Plan. CWO specific items are limited to the WBS and the details of the CWO.

4.1 Subcontractors

- **Computer Sciences Corp (CSC):** Infotec Development Incorporated (IDI) and Computer Sciences Corporation (CSC) have formed a 'virtual corporation' to execute the ISDS contract. This 'virtual corporation' means there are common processes, commingled staff, and transparent parent-company identity for ISDS staff.

- Affiliates/Consultants -- Working with JPL, affiliates and consultants will be called upon as necessary to fulfill JPL requirements.

4.2 CWO Change Management

Change management for this CWO follows the process defined in the ISDS Program Management Plan and in the contract. Should changes be required, they would be documented in this section.

4.2.1 Directed Changes

There are no directed changes at this time.

4.2.2 Claims for Adjustment

There are no claims for adjustment at this time.

4.2.3 Anticipated Changes

Our expectation is that changes are currently limited to schedule changes, priority adjustment, and changing of build contents and that all of these are nominally within the scope of work and estimate for CWO 2.

4.3 Tracking the Work

The ISDS team's approach to measure software development effort is based on "earned value". "Earned value" for this CWO is discussed in detail in subsequent subsections.

4.3.1 Technical Performance Measurement

TBD

4.3.2 Earned Value Measurement Methods

TBD

4.3.3 Cost and Schedule Performance

4.4 Refine Estimates

Estimates are refined in two ways. First, earned value techniques allow us to reflect experience (good experience or bad experience) from one task phase into a subsequent phase. Second, cost and schedule estimation becomes an agenda item at each major review in order to make the estimates and their assumptions visible to both JPL and ISDS team, a "no surprises" approach to CWO management.

4.5 Software Progress Metrics Plan

The software progress metrics plan to Manage the CWO and to improve our processes is that describe in the project metrics plan with the following exceptions: ***TBD***

5. Risk Management Plan

There is risk associated with late arrival of staff to replace the departing TELOS personnel. The extent of this risk will be better known when ISDS staff programmers arrive at JPL. It is hoped the caliber of these programmers will be sufficient to mitigate the risk associated with a late start on this CWO. All CWOs are monitored for unexpected developments.

6. Work Breakdown Structure (WBS)

The WBS for CWO 2 is shown on the following page. The most used WBS numbers are those in bold type.

WBS Number	Description of Work
11	**CWO management, planning, reporting, estimating**
13	CWO specific Process Assurance (= CM, QA, data management)
15	Data management: Final document packaging, editing, publication preparation, and checking for completeness
22	Mission/System Requirements Analysis (SRR)
23	System Analysis & Design (SDR)
27	Engineering change analysis & design
31	**CPA Operability**
311	**Software requirements analysis (SRR)**
312	**Software Design (PDR and CDR)**
313	**Implementation, unit test, developer integration & draft user doc't**
314	Initial software maintenance
315	Data generation & conversion
3n	ISDS acquired software
3n1	Acquisition costs: locating, benchmarking, trial use, product evalutaion, buying it
3n2	Studies and labor for modifications
3n4	Initial software maintenance
381	Program support library
382	Data base design & administration
383	Final document packaging, editing, publication preparation
391	Independent Build test: planning, scenarios, testing, anlaysis, reporting
399	Formal & acceptance test: planning, scenarios, testing, anlaysis, reporting
5	System test
6	Data
74	System Installation & checkout
75	Supporting system operation
76	**System maintenance**
761	**Bit slip - AR # 21435**
762	**High bit rate Command Aborts for short elements - AR # 22451**
763	**CPA, erroneous delay re-compute - AR # 23951**
764	**CPA tone block storage - AR #23952**
765	**TODR termination - AR # 23954**
766	**Sporadic shift register alarms causing cmd abort AR # 23955**
767	**Pioneer 10/11 subcarrier freq. alarms**
768	**CPA display: 26M xmitter bypass and PA status AR # 18159**
81	Training ISDS staff
84	Training preparation: audience identification & assessment, syllabus generation, creating lessons & training materials
85	Holding training classes

7. CWO Organization and Staffing

This section of the CWO Implementation Plan shows our staff and schedule estimates and describes the processes used to create and refine them. Figure xxx shows the CWO implementation schedule against the WBS.

7.1 CWO Staff Names, Qualifications, & Availability

Randy Tang is the cognizant ISDS programmer for CPA OP-C software. Mr. Tang represents a rich background in UNIX/C and Ada development environments, with experience on deverse development and application platforms. He has some experience in Object Oriented Analysis and Design.

A mix of ISDS staff will provide clerical and administrative support, as required.

Jerry Hill has a successful background in project management, using modern methodologies and CASE tools. He is the ISDS CWO Manager and author of this WIP.

7.2 CWO Organization

The programming staff for this CWO was inherited from the previous contractor, Telos. Though the manner in which the current development is approached will change very little, the organization is being built to support modern development techniques and provide lower cost administrative support for clerical tasks. Programmers, in the future will learn CASE and modern SEI-oriented development processes. They will provide only highly technical services. CM and clerical duties will be performed by less technical staff members. ISDS will work in cooperation with JPL to slowly bring about positive change with which we are in agreement. The organization is being structured to support this anticipated change. Paragraph 7.2.1 shows the CWO task organization.

7.2.1 CWO in the ISDS Project Organization
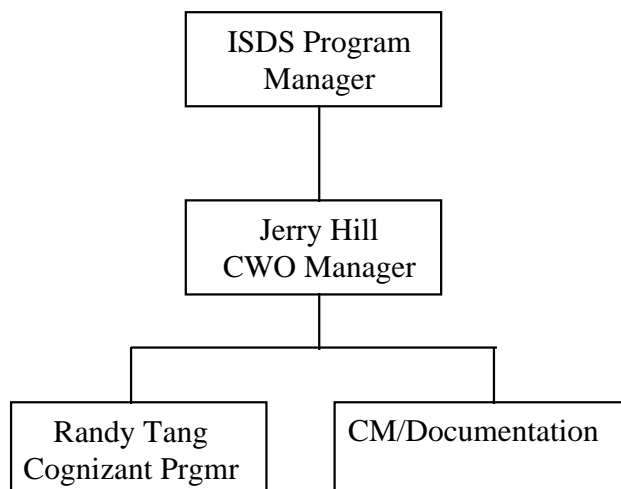
7.2.2 CWO in the JPL Organization

CWO 2 reports to Mr. Bill Stinnett, the JPL Task Manager.

7.3   Staffing Profile

CWO 2 has a flat staffing profile over the duration of the CWO.

7.4   Estimation Approach

Each of the work segments is estimated based on data drawn from within the JPL environment, from the experience of the cognizant programmer and from persons with Domain knowledge.

7.4.1   Size Estimation

Size estimation is based on identifying all units (e.g., subroutines, functions, packages, interface descriptions, test scenarios, tools) which have to be created or altered (e.g., a little or a lot). Unit counts are converted into Delivered Source Instructions (DSIs) and applied to a COCOMO based estimating model.

7.4.2   Underlying Assumptions for the Sizing Estimate

Sizing estimates are in progress.

Section 5, Risk Management, describes the effects on the estimates should these assumptions not hold.

7.4.3   Overall Staff Profile and Schedule

This CWO has a planned flat staffing profile. Schedules have been, thus far made and maintained by the CDE.

7.4.4   Maintenance (Sustaining Engineering) Effort

There is a maintenance effort between deliveries and after the final delivery.

There will be between xK and yK lines of code to maintain at each delivery. Using a (JPL defensible) number of   ***TBD***   Source Lines of Code (SLOC) per staff year and not having a significant requirement change, between nn and mm staff years per year are required for ongoing maintenance.

We can expect this level between the first and second deliveries and after the second delivery.

7.4.5   Smooth the Schedule and Staff Profile

ISDS staffing provides a flat staffing profile.

7.4.6   Apply the Staffing to the WBS

Refer to section 6 for the WBS.

8.   CWO Schedule and Dependencies

8.1   Schedule

Schedule will be provided subsequent to the arrival of Randy Tang.

8.2   Dependencies

Dependencies are those items outside the control of the CWO manager. We identify them here so we can plan for and manage them. Critical dependencies, if any, are included in the Risk Management Plan. There are only a few dependencies on this CWO. They are:

- Mission constraints: There are no identifiable mission constraints at this time.

- JPL facilities: Cognizant programmer use ISDS-provided office space.

- JPL support: ***TBD***. Documentation and CM support is currently being provided by JPL. ISDS has the capability to provide documentation and CM support.

- User availability: Users will be required for training and demonstrations.

- Site personnel: ***TBD***

- GFE/GFI: Network access to the JPL Lab.

9.   GFE/GFI Items

There are currently no GFE/GFI items required for this support other than those mentioned above.

10.   Close-out Plan

This section will be provided within 30 days from the end of this CWO.

11.   Deviations, Waivers, & Exceptions

This section of the CWO Implementation Plan will contain only deviations known at the time of the plan. The list and details of the deviations and exceptions and their waiver status is maintained in the problems data base and reflected in applicable CWO documents (e.g., Software Specification) as applicable.

This CWO has no deviations to established standards and procedures.

12.   Appendices

The appendices would normally contain the process descriptions and data dictionary entries for items that appear on System Models, Data Flow Diagrams, and Structure Charts. They are organized alphabetically to make them easy to find and are presented in "structured English" to simplify communication. If CASE tools are used these Appendices provide reference to the machine readable files.

12.1 Process Descriptions

This contains the analysis and design, typically the structured analysis or object oriented analysis and design.

12.2 Module Specifications

This section contains the design and module descriptions

12.3 Data Dictionary

The Data Dictionary Entries (DDEs) define the content of the data used by the CWO. The DDEs presented below are a superset of the definitions, data flows and data couples that appear on the models , Data Flow Diagrams, screen definitions, and Structure Charts included in section 1.4 of the CWO Implementation Plan.

If no CASE tool was used, then

The text within this data dictionary is a variant of Backus-Nauer Form (BNF). The entries are arranged alphabetically without regard to case, the same way an English dictionary is arranged. Some definitions are English text and some use the following notational conventions:

::= is read as "is defined as"

+   is "and". a+b means both a and b

| means "exclusive or". a|b means either a or b, but not both

[]   means optional

m[]n means at least m but no more n of them are required. Using n instead of a number for the maximum means an undefined number of repetitions are permitted.

[]n means optional but there can be more than one.

()   Parentheses are used to clarify grouping